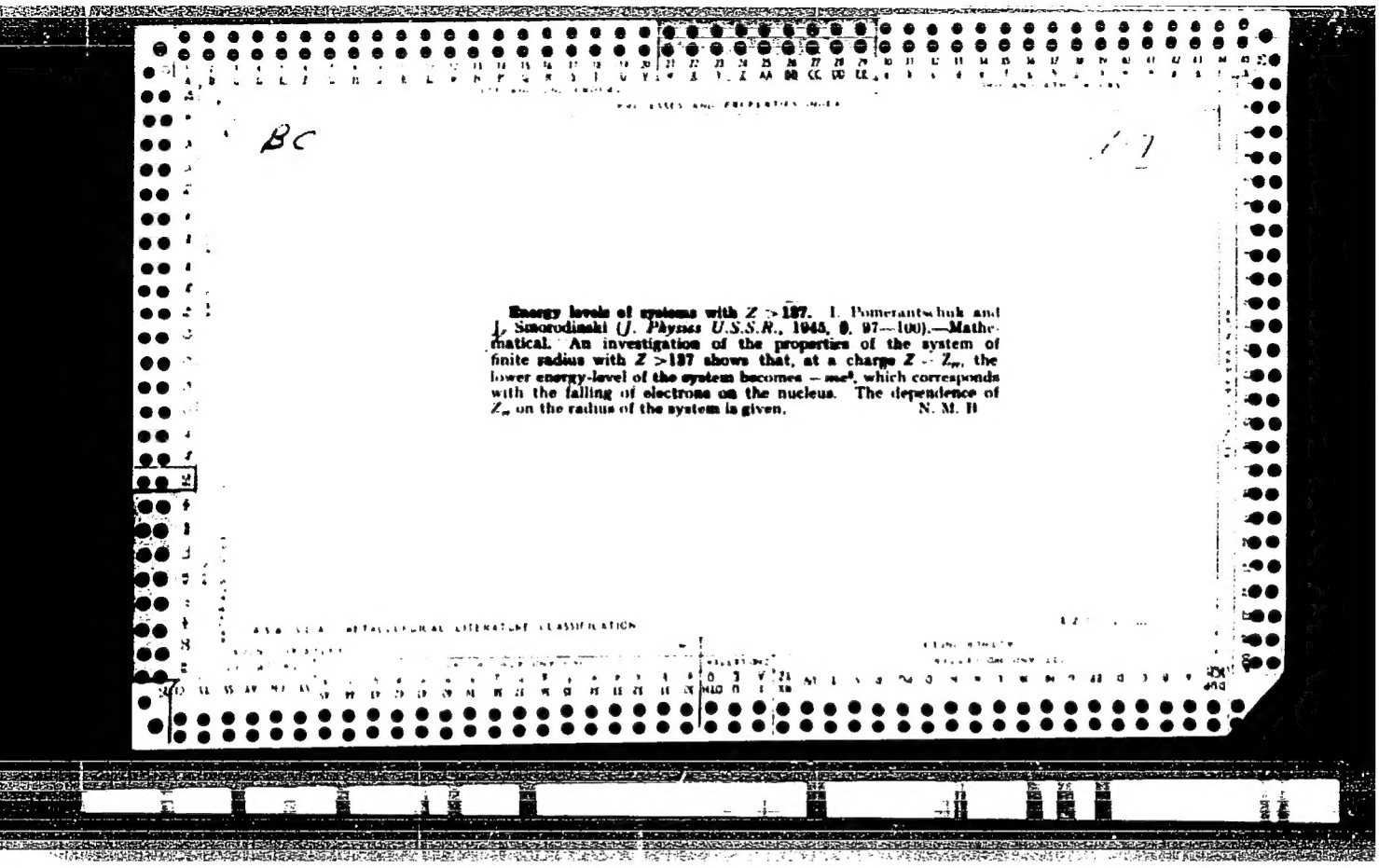
Theory of scattering of protons by protons. L. Landau and J. Smorodinski (*J. Physics U.S.S.R.*, 1944, **8**, 154—162).—The theory is worked out on the assumption (cf. Bethe and Peierls, *A.*, 1935, 279) that the non-Coulomb forces between two protons can be allowed for by a change of the boundary condition for the wave-function at the origin. Analysis of the experimental data enables the boundary condition to be fixed, and it is shown that the result prohibits any stable level for a diproton. H. J. W.

PROCESSES AND PROPERTIES INDEX

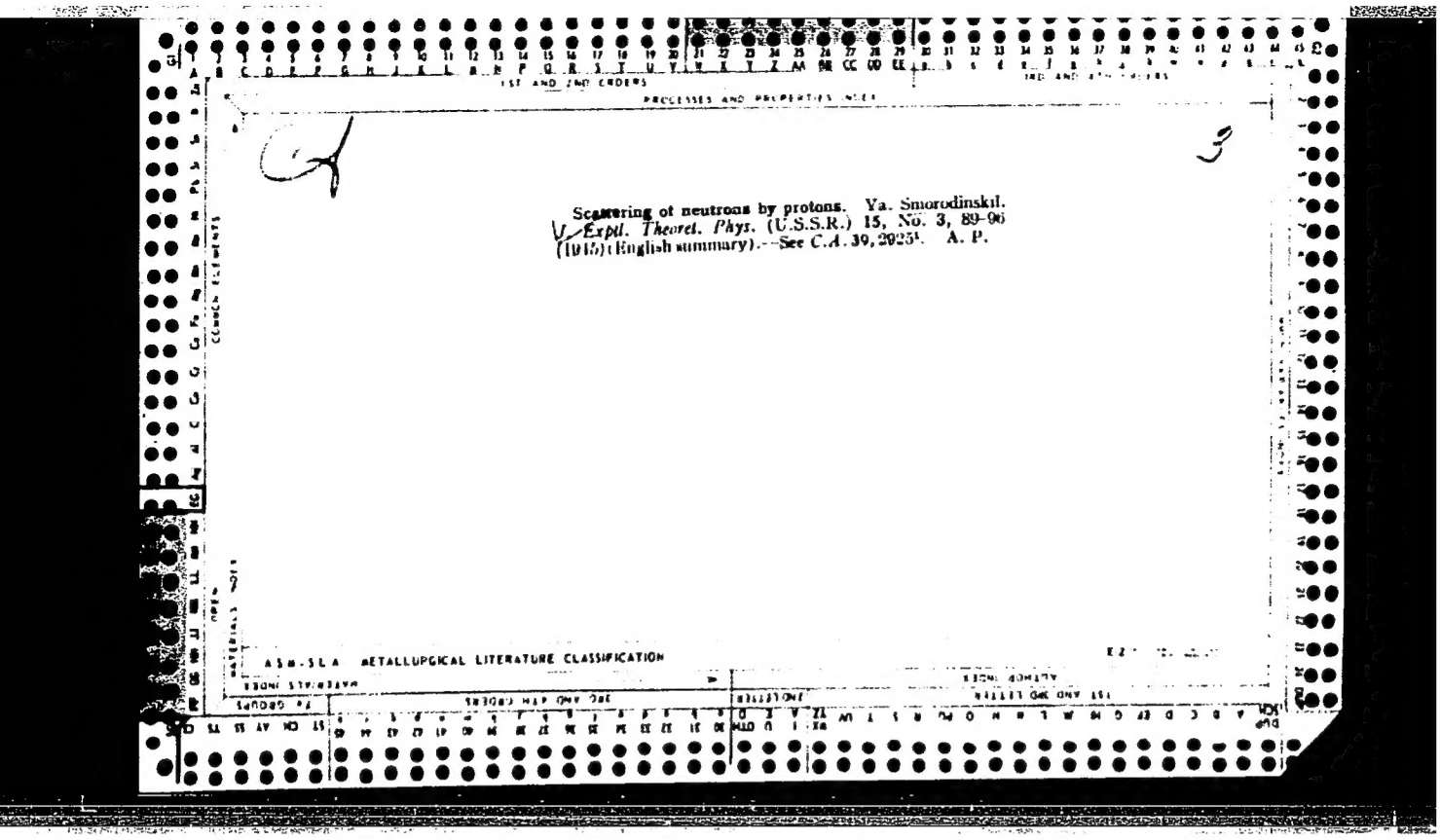
539.185.7 680

On the scattering of neutrons by protons. Smorodinsky, J. *J. Phys., USSR*, 8 (No. 4) 219-24 (1944).—A formula for the cross section, which is a modification of Wigner's formula [Abstr. 2929 (1936)] is proposed. The constants appearing in the formula are found from an analysis of experimental data, especially that of Amaldi, and no special assumption is made about the mode of interaction. The effect of the *P*-wave on scattering is discussed, and a formula is obtained for the cross-section for the *P*-scattering. This is a generalization of the Bethe-Peierl's formula. A comparison of results is made with the scattering of protons by protons. L. S. O.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION



Energy levels of systems with $Z > 137$. I. Pomerantschuk and J. Smorodinski (*J. Physics U.S.S.R.*, 1945, **9**, 97—100).—Mathematical. An investigation of the properties of the system of finite radius with $Z > 137$ shows that, at a charge $Z = Z_{cr}$, the lower energy-level of the system becomes $-mc^2$, which corresponds with the falling of electrons on the nucleus. The dependence of Z_{cr} on the radius of the system is given. N. M. H



Scattering of neutrons by protons. Va. Smorodinskiĭ. *Zhur. Eksptl. Theoret. Phys.* (U.S.S.R.) 15, No. 3, 89–96 (1945) (English summary).—See *C.A.* 39, 2925⁵. A. P.

SMORODINSKIY, YA. A.

"Concerning the Formula for the Isotopic Shift," Journal of Physics, Vol. 10, No. 5, pp. 419-21, 1946.

SMORODINSKIY, J.

PA 13T90

USSR/Neutrons - Scattering
Protons - Scattering

Feb 1947

"The Scattering of Neutrons by Protons, II," J. Smorodinskiy, 2 pp

"Jour Physics USSR" Vol XI, No 2

A letter to the editor expanding earlier remarks on the subject, including the modification of the usual Wigner's formula for the scattering phenomenon.

13T90

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Theory of scattering of neutrons by protons Ya. Smorodinskiĭ. *Zhur. Eksptl. Teoret. Fiz.* **17**, 911 (1947); cf. *C. A.* **39**, 2025; **43**, 7322. The formula of Wigner for the scattering cross section of protons bombarded by neutrons is extended. For energies between a small fraction of 1 m.e.v. and 6 m.e.v. good agreement with exptl. results is given by $\sigma = 1.3013 \left[(1.22 - 0.06E)^2 + (E/2)^2\right] + 1.00 \left[(0.27 + 0.06E)^2 + (E/2)^2\right] \times 10^{-24}$ sq. cm. F. H. Murray

Electronic Phenomena
3

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Formula for the isotopic shift. Ya. Smorodinskii (Acad. Sci. U.S.S.R.). *Zhur. Eksptl. Teoret. Fiz.* 17, 1031-6 (1947).—The isotopic shift in the spectra of heavy atoms is derived in a form more accurate than the formulas of Rosenthal and Breit (*C.A.* 26, 5493) and Racah (*C.A.* 26, 3991) by the method of perturbation of boundary conditions. The final expression differs from that of R. by the factor $2\rho\Gamma(2\gamma+\rho+1)/\Gamma(1+2\rho)\Gamma(1+\rho)\Gamma(2+\rho)$, where $\rho^2=1-(Ze^2/\hbar c)^2$. For $\rho=1$, i.e. for light nuclei, the new formula and that of R. coincide. For Hg, the new formula gives a shift 0.8 that given by the formula of R. N. Thon

SMORODINSKIY, YA.

PA 62T95

USSR/Nuclear Physics - Wave Mechanics Apr 1948
Nuclear Physics - Deuterons

"Normalization of the Wave Function of the Deuteron," Ya. Smorodinskiy, 2 pp

"Dok Akad Nauk SSSR, Nova Ser" Vol LX, No 2

Describes the calculations to the integral $\int_0^\infty f^2 dr$ necessary for the normalization of Bett's, and Peyerl'som approximation of the wave function of deuterons: $\psi_d \sim \frac{1}{re}^{-\alpha r}$.

Submitted by Academician L. D. Landau, 17 Feb 1948.

62T95

SMORODINSKIY, YA. A.

PA 153T96

USSR/Physics - Spectroscopy Nov 49
Electron

"The Displacement of Terms of Hydrogenlike Atoms and the Anomalous Magnetic Moment of the Electron," Ya. A. Smorodinskiy, 4 pp

"Uspekhi Fiz Nauk" Vol XXXIX, No 3

Obtains approximate expression for the energy W of a hydrogenlike atom calculated according to relativity effect. Hence the deviation of theoretical spectral terms from experimental ones is found. New high-accuracy superfine structure now known thus permits one to test Dirac's electron theory.

153T96

SMORODINSKIY, Ya. A.

168T61

USSR/Nuclear Physics - Mesons Jun 50

"Artificial π-Mesons," A. B. Migdal, Ya. A. Smorodinskiy

"Uspekh Fiz Nauk" Vol XLI, No 2, pp 133-153

Discusses artificial production of π-mesons using Berkely cyclotron in 1947. Lists only four Soviet sources, all for the introduction on varitrons.

168T61

SMORODINSKIY, YA. A.

USSR/Physics - Proton scattering

FD-750

Card 1/1 : Pub 146-20/22

Author : Smorodinskiy, Ya. A.

Title : Polarization during scattering of protons by protons

Periodical : Zhur. eksp. i teor. fiz., 27, 123-124, Jul 1954

Abstract : Letter to the editor. Study of polarization is a very sensitive method for determining variation of cross section with varying incidence angle. Experimental data obtained by C. L. Oxley (Phys. Rev. 91, [1953]) is used in this analysis. 2 US references

Institution : --

Submitted : April 27, 1954

FD-1492

USSR/Nuclear Physics - Proton Interaction

Card 1/1 : Pub. 146-15/20

Author : Baz, A. I., and Smorodinskiy, Ya. A.

Title : Interaction of protons with H^3 and excited states of the alpha-particle (Letter to the editor)

Periodical : Zhur. eksp. i teor. fiz., 27, 382-384, Sep 1954

Abstract : Analysis of the H^3 (p, n) He^3 reactions is carried out; in particular, the analysis of the results obtained by H. B. Willard et al. (Phys. Rev. 90, 865 (1953). The improbability of the existence of a stable H^4, is indicated. One aforementioned reference.

Institution :

Submitted : April 27, 1954

Smorodinskiy, Ya. A

USSR/Physics - Neutrinos

Card 1/1 Pub. 118 - 1/8

Authors : Zel'dovich, Ya. B.; Luk'yanov, S. Yu.; and Smorodinskiy, Ya. A.

Title : Properties of a neutrino and the double β-decomposition

Periodical : Usp. fiz. nauk 54/3, 361-404, Nov 1954

Abstract : Experimental and theoretical studies of neutrino properties (indivisibility, evenness, spin and mass) are described. The reactions ($n \rightarrow p + e^- + \tilde{\nu}$ and $p \rightarrow n + e^+ + \nu$) leading to the formation of neutrinos are analyzed in the light of the quantum theory with application of Pauli's matrix transformations for the Dirac equation describing the wave function ψ. The probability of a double β-decomposition (simultaneous formation of $\tilde{\nu}$ & ν) is theoretically established and experiments performed by various investigators with the help of analyzers and the method of scintillations are described and analyzed. Thirty-nine references 3-USSR (1935-1954). Tables; graphs; diagrams.

Institution : ...

Submitted : ...

LANDAU, Lev Davydovich; SMORODINSKIY, Yakov Abramovich; ALEKSEYEV, D.M., redaktor; GAVRILOV, S.S., tekhnicheskiy redaktor.

[Lectures on the theory of the atomic nucleus] Lektsii po teorii atomnogo iadra. Moskva, Gos. izd-vo tekhniko-teoret. lit-ry, 1955. 140 p. (Nuclear physics) (MLRA 9:4)

FRENKEL', Ya.I.; SMORODINSKIY, Ya.A., professor, redaktor; PEVZNER, R.S., tekhnicheskiy redaktor

[Principles of the theory of atomic nuclei] Printsipy teorii atomnykh iader. 2-e izd. Moskva, 1955. Izd-vo Akademii nauk SSSR, 1955. 247 p. (MLRA 8:8)
(Nuclei, Atomic)

SMORODINSKIY, Ya.A.

Theory of double β-decay. L. A. Maksimov and Ya. A. Smorodinskiĭ, *Bull. Acad. Sci. U.S.S.R., Phys. Ser.* 19, 326–37(1955)(Engl. translation); *Izvest. Akad. Nauk S.S.S.R., Ser. Fiz.* 19, 365–76(1955).—The matrix element for the transition of 2 nucleons in Ca^{48} was computed from shell theory. Only ground state to ground state transitions were considered in the calcns. The effect of interaction of the 2 nucleons with the core was taken into account by the introduction of a correction factor. On the basis of the independent particle model the nuclear matrix elements for scalar and tensor interaction were computed for transitions to the states I and II States I and II are: I $J = 0$, $T = 4$, $s = 0$ and II $J = 0$, $T = 2$, $s = 0$, T being the isotopic spin. Also the half-sum of the matrix elements of the transitions to the 2 states with $s = 4$ was evaluated. The construction of the wave-functions, the normalization, and the computation of the 2 matrix elements are given in detail. It is found that the most probable value of the square of the nuclear matrix element is 0.3 and the lifetime for double β-decay is $T_{1/2} = 0.5 \times 10^{18}$ yr., for 4.3-m.e.v. transition energy.

I. C. Roy

Smorodinskiy, Ya.

USSR/ Nuclear physics - Isotopic spin

Card 1/1 Pub. 118 - 2/3

Authors : Vyaz', A. and Smorodinskiy, Ya.

Title : Isotopic spin of light nuclei

Periodical : Usp. fiz. nauk 55/2, 215-264, Feb 1955

Abstract : A theory of the isotopic spin of nuclons (proton or neutron) is presented. The presentation is not given in a strictly mathematical manner, but, rather in a plain descriptive form. This was done to justify the charge invariance hypothesis introduced into nuclear physics for explanation of certain observed phenomena. The theory of isotopic spin of nuclei is considered as the simplest and easiest method of proving the mentioned hypothesis. A description of the energy levels of light nuclei ($A<50$), with corresponding diagrams and their analysis in the light of the isotopic spin theory is presented. Twenty-six references: 6 USSR, 14 USA, 4 Brit., 1 German and 1 Italian (1952-1954). Diagrams; graphs.

Institution : .....

Submitted : .....

SMORODINSKIY, Ya.

β-Decomposition for light nuclei. Ya. Smorodinskii. *Uspekhi Fiz. Nauk* 56, 201–14(1956); cf. preceding abstr.—The exptl. results described previously for nuclei of low at. wt. are analyzed. The value of R, which characterizes the mixt. of the tensor and scalar variants in the Hamiltonian for the β-decompn., is given as 1.7. This value is compared with values reported earlier. The half-life of the neutron, $(n \rightarrow p + \beta)$ with this value of R, is 10.2 ± 0.5 min. The analysis of the data for light nuclei shows that there is predominant evidence for the shell structure of nuclei.

J. Rovtar Leach

SMORODINSKII, Ya

The dimensions of nucleons. Ya. Smorodinskii. *Uspekhi Fiz. Nauk* 56, 425–8(1955).—On the basis of literature data, S. shows that the nucleus is comparatively empty and that the nucleons occupy only $^1/_{\infty}$ of its total vol. J. R. L.

SMORODINSKIY, Ya.

USSR/ Nuclear physics

Card 1/1 Pub. 22 - 18/46

Authors : Ryndin, R. and Smorodinskiy, Ya.

Title : Similar transformations of nonpolarized particles

Periodical : Dok. AN SSSR 103/1, 69-71, Jul 1, 1955

Abstract : Studying the dispersion of nonpolarized particles with nucleons, the author determined the amplitude of the dispersion up to the precision of the sign before the operator $\rightarrow S_n$, i.e., he reached the same precision in the determination of the amplitude or the cross-section of a dispersion, as Minami did in his determination of the π-meson dispersion by nucleons (polarized). Both the author and Minami proved the invariance of the amplitude of dispersion. In the above mentioned operator n, the n is a single vector normal to the plane of dispersion $n = \left|\frac{K \times K_o}{K \times K_o}\right|$. Two USA references (1950 and 1954).

Institution : The Acad. of Sc., USSR, Institute of Nuclear Problems

Presented by: Academician L. D. Lindau, March 24, 1955

SMORODINSKIY, Ya. A.

Correlation for the planes of decomposition of V^0 pairs and the spin of the ϑ^0 meson. L. D. Puzikov and Ya. A. Smorodinskiĭ. *Doklady Akad. Nauk S.S.S.R.* 104, 843–5 (1955).—Math. The following conclusions are drawn: The presence of correlation requires that the spin of A^0 be large ($\geq 7/2$); the spin of ϑ^0 be different from 0; and that the spin of ϑ^0 be much smaller than the spin of A^0.

J. Rovtar Leach

SJBJECT USSR / PHYSICS
AUTHOR SMORODINSKIY, YA.A.
TITLE The Problems of the Physics of Particles with High Energies discussed at the Symposium of the European Center for Nuclear Research (CERN) at Geneva. (Impressions gathered by the Delegate from the USSR).
PERIODICAL Atomnaja Energija, 1, fasc.5, 140-142 (1956)
Issued: 1 / 1957

According to the author's opinion outstanding success was achieved in the following 4 directions: 1) Discovery and investigation of the properties of the antiproton. 2) The scattering of electrons by a proton and the structure of the proton. 3) Scattering of photons by protons. 4) π-mesoatoms.
Antiproton: The discovery of the antiproton confirms the charge symmetry of elementary particles. At present a search is already being made for the antineutron and for the antihyperon, i.e. the neutral Λ -antiparticle as well as the positive and neutral Ξ -antiparticle. A whole family of Σ -antiparticles seems to exist. According to the first measurements of the interaction between the antiproton and Be- and Li-nuclei, the corresponding interaction cross section is double the cross section of the interaction between a proton and these nuclei. This applies in the case of 400 MeV-antiprotons. This paradoxical result necessitates further research work.
Scattering of Electrons by Protons: (HOFSTADTER and CHAMBERS, Stanford University, USA). Experimental difficulties arising in connection with the

SMORODINSKIY, Ya-A.

CARD 1 / 2 PA - 1446

SUBJECT USSR / PHYSICS
AUTHOR COLUBENKOV,V.N., SMORODINSKIJ,JA.A.
TITLE The LAGRANGIAN for the Systems of Uniform Charged Particles.
PERIODICAL Žurn.eksp.i teor.fis,31,fasc.2, 330-330 (1956)
Issued: 10 / 1956 reviewed: 10 / 1956

According to C.DARWIN, Phil.Mag.39, 537, 1920 it is possible to write down the LAGRANGIAN for a system of charged particles with an accuracy extending up to the terms of second order with respect to the ratio (velocity of particles / velocity of light). Here attention is drawn to a possibility of determining the LAGRANGIAN for a system of uniform particles in higher approximation. In a system of uniform particles (or more accurately: having the same ratio between charge and mass) radiation is proportional not to the third but to the fifth power of v/c. Therefore the LAGRANGIAN can be written down for such a system up to terms v^4/c^4, and the easiest method of computation is that described in the book by LANDAU-LIFŠIC.

The terms of the third order in the LAGRANGIAN are equal to zero. Computation of the terms of the fourth order leads to the following additional expression added to the LAGRANGIAN of the second order:

$$L^{(4)} = -\sum_a \frac{m_a v_a^6}{16c^4} + \frac{e^2}{8c^4} \sum_{b>a} \frac{1}{R_{ab}} \left\{ 2(\vec{v}_a \vec{v}_b)^2 - v_a^2 v_b^2 + (\vec{n}\vec{v}_a)^2 v_b^2 + (\vec{n}\vec{v}_b)^2 v_a^2 - \right.$$

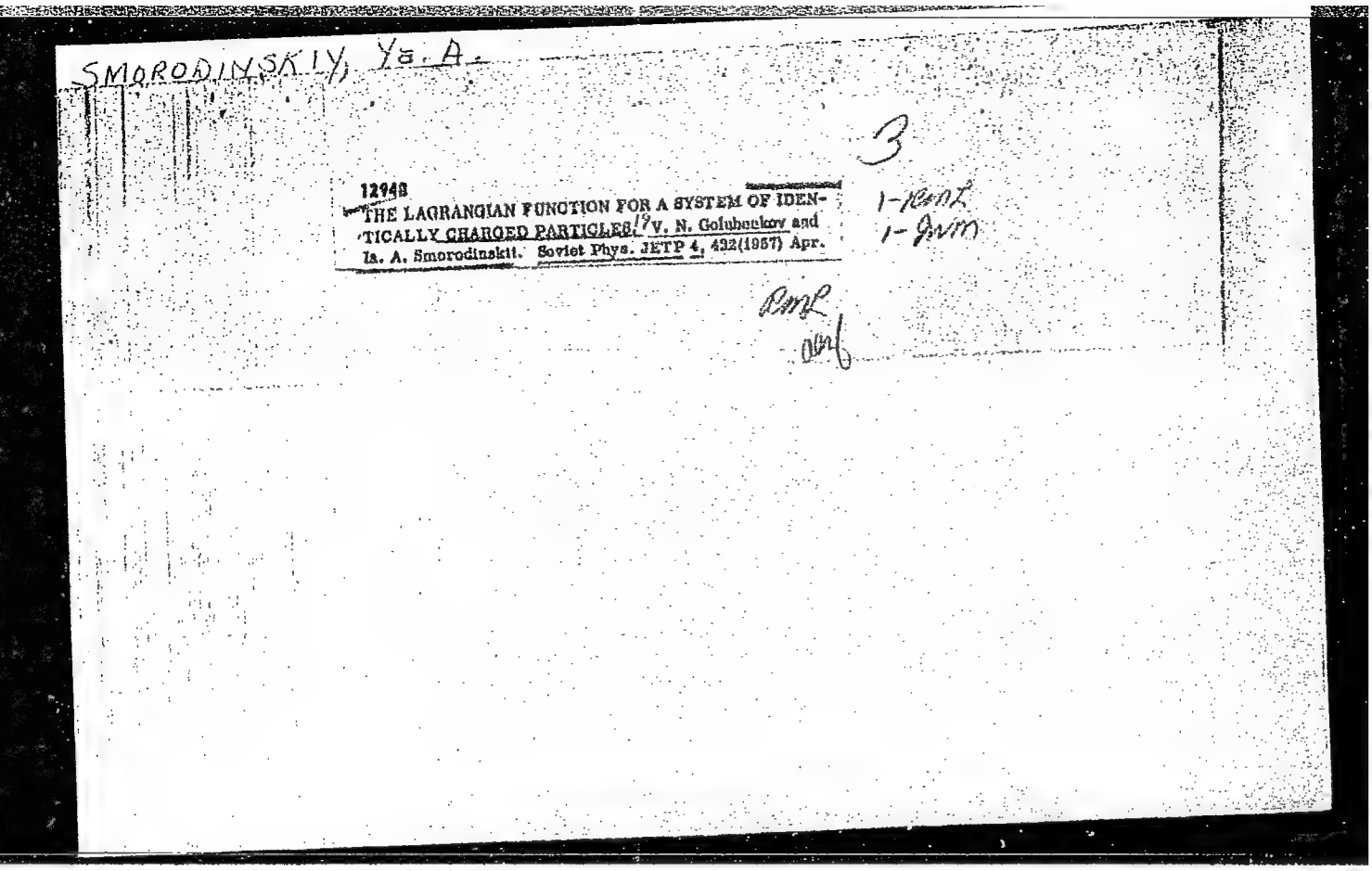
$$\left. - 3(\vec{n}\vec{v}_a)^2 (\vec{n}\vec{v}_b)^2 \right\} + \frac{e^2}{8c^4} \sum_{b>a} \left\{ 2 (\vec{n}\vec{v}_a)(\vec{v}_a \dot{v}_a) - 2 (\vec{n}\vec{v}_b)(v_b \dot{v}_a) - \right.$$

SMORODINSKIY, Yar [A]

19

3009. CONSTRUCTION OF THE SCATTERING MATRIX OF A TWO-NUCLEON SYSTEM. L. Puzikov, R.Ryndin and J.Smorodinsky. Nuclear Physics, Vol. 3, No. 3, 436-45 (May, 1957).

The problem of the number of experiments which are necessary for the determination of the elements of the elastic scattering matrix is discussed. It is shown that in virtue of the unitarity condition the required number of experiments equals the number of complex functions entering the scattering matrix. In the case of nucleon-nucleon scattering the elastic scattering matrix can be determined on basis of five experiments: measurement of the cross-section, polarization, normal component of the polarization correlation tensor and the normal components of the triple scattering tensor (for both particles). It is shown that experiments with rotation of polarization by the external magnetic field are not necessary for phase-shift analysis.



SMORODINSKIY, Ya. A.

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12948
THE LAGRANGIAN FUNCTION FOR A SYSTEM OF IDENTICALLY CHARGED PARTICLES. V. N. Golubenkov and Ia. A. Smorodinskii. Soviet Phys. JETP 4, 432(1957) Apr.

1-Kent
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SMORODINSKII, Ya.A

4523

RECONSTRUCTION OF THE SCATTERING MATRIX OF A TWO-NUCLEON SYSTEM. L. Puzikov, R. Ryndin, and Ja. Smorodinskii (United Inst. for Nuclear Studies). Soviet Phys. JETP 5, 489-95(1957) Oct.

The types of experiments needed for determination of all elements of the scattering matrix are investigated. It is shown that because of the unitarity condition the required number of experiments equals the number of complex functions entering into the scattering matrix. For nucleon-nucleon scattering, the inelastic scattering matrix can be determined on the basis of five experiments measuring the cross section, polarization, normal components of the polarization correlation tensor and of the triple scattering tensors (for the scattered and recoil particles). It is shown that experiments involving spin rotation by a magnetic field are not necessary for a phase shift analysis. (auth)

Distr: 4E3d

PA - 2976

AUTHOR: PUZIKOV,L., RYNDIN,R., SMORODINSKIY,YA.
TITLE: The Setting up of a Scattering Matrix in a System of Two Nucleons.
PERIODICAL: (Zhurnal Eksperim. i Teoret. Fiziki, 1957, Vol 32, Nr 3, pp 592-600
(U.S.S.R.)
Received: 6 / 1957 Reviewed: 7 / 1957

ABSTRACT: The present paper is destined to show what experiments are necessary for the determination of all elements of the scattering matrix. It is further shown which of these experiments are independent in the sense that in the case of known experimental results the matrix can be completely constructed. For the reasons of better illustration the authors begin with the two most simple cases: scattering of particles with spin zero in a central field, and of particles with spin 1/2 on spinless nuclei. The scattering of nucleons on nucleons is then examined. The case with any spin and the scattering of photons are examined in later reports. The present paper is confined to the examination of the scattering matrix in the case of an assumed energy. Also the problem of the energy dependence of the matrix elements require additional investigations

The scattering of spin-less particles: Measuring of the scattering cross section in the case of an assumed energy is at all angles a complete test in the sense that the complete construction of the scattering amplitude is made possible (perhaps apart from the

Card 1/3

56-5-33/55

AUTHOR RYNDIN, R.M., SMORODINSKIY, Ya.A.

TITLE The Minami Transformations for the Scattering of Nucleons by Nucleons. (Preobrazovaniya Minami dlya rasseyaniya nuklonov nuklonami-Russian)

PERIODICAL Zhurnal Eksperim.i Teoret.Fiziki,1957,Vol 32,Nr 5,pp 1200-1205 (U.S.S.R.)

ABSTRACT The paper under review shows the following: The transformation of phases which leaves the scattering cross section invariant- this transformation having been demonstrated for the case of sca- ttering of pions by nucleons-has no analogue for the case of sca- ttering of nucleons by nucleons .Although such a transformation exists it is not sufficient in the light of thephysical conditions of the problem. As a matter of fact,the symmetry of the system re- quires that the phases do not dpend on m(the magnetic quantum num- ber of the system).But the phases obtained by the transformations investigated here do depend on |m|.Unlike earlier expectations,the- re thus does not exist any ambiguity of phases imilar to that in a system with the total spin 1/2.Furthermore,the authors of the pa- per limit their investigations to the examination of the scattering of protons by protons, because the more general case of the sca- ttering of neutrons by protons does not bring out any essentially new aspects of the problem.
The amplitudes and the differential cross section of scattering: This chapter contains a brief discussion of a methodfor the des- cription of collisions between particles of the same kind having the spin 1/2.This chapter also contains the amplitudes of the

Card 1/2

On the Unitarity Relations for the Elastic Collisions of Particles with Arbitrary Spins. 56-6-49/56

normalization functions as the functions of the inciding wave. At $r \to \infty$ they form a complete system of functions with respect to the angle variables. After some computing the required integral relation for the scattering matrix is obtained. He reform there follow integral relations for the coefficients of the development according to the invariant spin matrices. Also a generalization of the optical theorem for particles with a spin that is different from zero is obtained:

$$4\pi \operatorname{Im} \operatorname{Sp} M(\vec{k}, \vec{k}) = k (2s_1 + 1)(2s_2 + 1)\sigma.$$

(No Illustrations)

ASSOCIATION: United Institute for Nuclear Research. (Ob "yedinennyy institut yadernykh issledovaniy.- Russian)
PRESENTED BY: -
SUBMITTED: 20.[illegible]. 1957.
AVAILABLE: Library of Congress.

CARD 2/2

BAZ, A. I., and SMORODINSKIY, I. A.

"Sur la Possibilite de Detection du Dineutron."

report presented at the International Congress for Nuclear Interactions (Low Energy) and Nuclear Structure, Paris, 7-12 July 1958.

89-1-22/29

AUTHOR: Smorodinskiy, Ya. A.

TITLE: The Conference of Yugoslav Physicists (Konferentsiya yugoslavskikh fizikov)

PERIODICAL: Atomnaya Energiya, 1958, Vol. 4, Nr 1, pp. 1o2-1o3 (USSR)

ABSTRACT: The II. Conference took place in the summer of 1957 in form of a "summer school" and was this time also attended by foreign physicists. The following lectures were held:
1. The Coulomb excitation of levels and the nuclear collective model (B.Motel'son,Denmark)
2. An optical nuclear model (Ch.Porter, USA)
3. Deuteron reactions (stripping) (A. Messiya, France)
4. Photo-nuclear reactions (K. Vol'dermut, Western Germany)
5. The scattering of high-energy nucleons (Ya.Smorodinskiy,USSR)

Besides these principal lectures also evening seminars were held. One of them was devoted to the present stage of the ß-theory.
Immediately after the conference had ended, the research centers of Yugoslavia were visited: 1. The Institute "Boris Kidrich" at Belgrade, where a reactor is at present being built.
2. The Institute "Ruder Boskovich" at Agram, where a cyclotron is at present being built. (Deuteron energy of up to 16 MeV).

Card 1/2

AUTHOR: Smorodinskiy, Ya. A. SOV/56-34-5-47/61

TITLE: The Analytical Nature of the Nonrelativistic Scattering Amplitude and the Potential (Analitichnost' nerelyativistskoy amplitudy rasseyaniya i potentsial)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 5, pp. 1333 - 1335 (USSR)

ABSTRACT: As is known the amplitude of the scattering of a particle in a central force field in the case of given angular momentum cannot be continued analytically into the upper semi-plane of the variable k. A reference to a proof of this assertion, which is connected with an inverse problem of the scattering theory is interesting. For the sake of conciseness it is assumed that the bound states are missing and that the scattering takes place in the s-state. The generalisation of the problem then is obvious. According to V.A.Marchenko (Ref 2) the solution of the equation $d^2\psi(x,k)/dx^2 + (k^2 - V(x))\psi(x,k) = 0$ in the form $\psi(x,k) = \varphi(x,k) + \int A(x,y)\varphi(y,k)dy$ can be represented by an

Card 1/3

integral according to the system of the functions $\varphi(y,k) = (2/\pi)^{1/2}\sin ky + \delta(k)$. $\delta(k)$ denotes the scattering phase known from experiments. In this equation $A(x,y)$ has to be determined from an integral equation the kernel and the inhomogeneous term of which can be expressed by the Fourier(Fur'ye) component of the scattering amplitude $M(k) = \exp\{2\pi i\delta(k)\} - 1$: $m(z) = (1/2\pi)\int M(k)e^{ikz}dk$ (at $z > 0$). If the scattering is described by a potential the amplitude either has a pole or it increases in the case of $k \to \infty$ ($\mathrm{Im}\, k > 0$) faster than a polynomial. If the potential is limited in space, ($V(x) = 0$ at $x > a$), $m(z)$ becomes equal to zero at $z > 2a$. If the scattering amplitude is known for all energies the function $g(E) = M(E,\tau) - V_\tau/4\pi$ can be continued analytically into the complex plane E (or into the upper semi-plane of k) and for this dispersion relations can be written down. If the scattering amplitude is known the potential is determined from the amplitude without solving of integral equations. This assertion only holds when the scattering amplitude is known for all energies. There are 4 references,

The Analytical N ture of the Nonrelativistic Scattering Amplitude and the Potential

SOV/56-34-5-47/61

2 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (United Institute of Nuclear Research)

SUBMITTED: January 24, 1958

1. Particles--Scattering 2. Particles--Mathematical analysis

Card 3/3

AUTHORS: Kagan, Yu. A., Smorodinskiy, Ya. A. SOV/56-34-5-55/61

TITLE: On the Anisotropy of the Even Photomagnetic Effect (Ob anizotropii chetnogo fotomagnitnogo effekta)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1958, Vol. 34, Nr 5, pp. 1346 - 1347 (USSR)

ABSTRACT: Kikoin and Bykovskiy recently in the investigation of the even photomagnetic effect in semiconductors with a cubic lattice discovered clearly expressed anisotropy phenomena. This paper gives a purely phenomenological description of the character of this anisotropy. This problem is characterized by three factors: The magnetic field strength $\vec{H}$, the interior normal $\vec{n}$ of the illuminated surface of the semiconductor along which the diffusion of the liberated carriers takes place, and the electric field strength $\vec{E}$. The magnetic field is assumed to be sufficiently weak. Then with an accuracy to square terms (with regard to $\vec{H}$) the general expression

$E_i = L_{ik}n_k + L_{ikl}n_k H_l + L_{iklm}n_k H_l H_m$ can be written down. Furthermore, the Cartesian system of coordinates is assumed

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to coincide with the axes of the cubic crystal. The expression for E_i can be transformed to the form

$$E_i = L_1 n_i + L_2 e_{ikl} n_k H_l + L_3 n_i H^2 + 2L_4 H_i n_k H_k + L'_5 n_i H_i^3,$$

$L'_5 = L_5 - L_3 - 2L_4$ (underlined indices are not to be summed up). The first term in this expression corresponds with the Dember effect (Ref 4), the second term with a certain photomagnetic effect, and the third term describes the even photomagnetic effect in that form as it occurs in an isotropic semiconductor. The last term indicates an anisotropy in the case of an even photomagnetic effect. When $\vec{H} \| \vec{n}$ the isotropic share of the even photomagnetic effect vanishes. Finally the expression of the magnetic field is written down for the special case that $\vec{n}$ agrees with the main diagonal axis. There are 6 references, 4 of which are Soviet.

SUBMITTED: February 21, 1958

SMORODINSKIY, Y A.

"Elastic Nucleon-Nucleon Scattering up to 1 Bev."

report presented at the Intl. Conference on High Energy Nuclear Physics, Kiev, 15-25 July 1959 (the session on Strong Interactions of Ordinary Particles.)

Lectures on Nuclear Theory, by L. D. Landau and Ya. Smorodinsky.
Rev. Ed. New York, Plenum Press 1959.

vii, 1[illegible] p. illus., diagrs., tables.
Translated from the Russian:
[illegible] po teorii atomnogo [illegible].

APPROVED FOR RELEASE: 08/31/2001 CIA-RDP86-00513R001651730004-4"

FRANK-KAMENETSKIY, D.A., prof., otv.red.; VORONTSOV-VEL'YAMINOV, B.A., red.; SMORODINSKIY, Ya.A., prof., red.; ZEL'MANOV, A.L., starshiy nauchnyy sotrudnik, red.; SAGDEYEV, R.Z., mladshiy nauchnyy sotrudnik, red.; SAMSONENKO, L.V., red.izd-va; SHEVCHENKO, G.N., tekhn.red.

[Transactions of the sixth conference on cosmogony; extra-galactic astronomy and cosmology] Trudy shestogo soveshchaniia po voprosam kosmogonii, 5-7 iiunia 1957 g.; vnegalakticheskaia astronomiia i kosmologiia. Moskva, Izd-vo Akad.nauk SSSR, 1959. 273 p. (MIRA 12:12)

1. Soveshchaniye po voprosam kosmogonii, 6yh, 1957. 2. Chlen-korrespondent Akademii pedagogicheskikh nauk SSSR (for Vorontsov-Vel'yaminov).
(Cosmology--Congresses)

21(0) PHASE I BOOK EXPLOITATION SOV/2081

International Conference on the Peaceful Uses of Atomic Energy, 2d., Geneva, 1958

Doklady sovetskikh uchenykh; yadernaya fizika (Reports of Soviet Scientists; Nuclear Physics) Moscow, Atomizdat, 1959. 552 p. (Series: Its: Trudy, Vol. 1) 8,000 copies printed.

Eds. (Title page): A.I. Alikhanov, Academician; V.I. Veksler, Academician; and N.A. Vlasov, Candidate of Physical and Mathematical Sciences; Ed. of this volume: B.I. Drozdov and B.F. Zaretskiy, Candidates of Physical and Mathematical Sciences; Ed. (Inside book): G.L. Smolyan; Tech. Ed.: Ye.I. Mazel'.

PURPOSE: This collection of articles is intended for scientific research workers and other persons interested in nuclear physics. The volume contains 43 papers presented by Soviet Scientists at the Second Conference on Peaceful Uses of Atomic Energy, held in Geneva in September 1958.

COVERAGE: It is divided into two parts. Part I contains 17 papers dealing with plasma physics and controlled thermonuclear reactions, and Part II contains 26 papers on nuclear physics, including problems of particle acceleration and of cosmic ray physics. The first paper by L.A. Artsimovich presents a review of Soviet work on controlled thermonuclear reactions. The remaining papers in Part I deal with particular problems in this field.

papers in Part II deal in detail with various problems in nuclear physics, such as the fission of heavy atoms and their isotopes, and with the study of cosmic radiation by means of artificial earth satellites and rockets, described in a paper by S.N. Vernov. The Russian-language edition of the proceedings of the conference is published in 16 volumes. The first 6 volumes contain all the papers presented by Soviet scientists as follows: Volume (1), Yadernaya fizika (Nuclear Physics); Volume (2), Yadernyye reaktory i yadernaya energetika (Nuclear Reactor and Nuclear Power); Volume (3), Yadernoye goryucheye metally (Nuclear Fuel and Reactor Metals), Volume (4), Khimiya radioelementov i radiatsionnykh prevrashcheniy (Chemistry of Radioelements and of Radiation Transformations); Volume 5, Radiobiologiya i radiatsionnaya meditsina (Radiobiology and Radiation Medicine); Volume (6) Polucheniye i primeneniye izotopov (Production and Use of Isotopes). The other 10 volumes contain selected papers presented at the Conference by non-Soviet scientists. In the present volume discrepancies between the English and Russian language edition of the proceedings have been noted in three articles where the texts are not identical; viz: Andrianov, et al, "High Current Pulsed Discharge"; Akhiyezer, et al, "High Frequency Plasma Oscillation"; and Bogolyubov, "Investigations of the Many-body Problem". The serial numbers of reports 2302 and 2504 are reversed in the English edition. Report 2211, by Simelnikov, et al, is numbered 2536 in the English edition.

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SMORODINSKIY, YA. A.

21 (7), 21 (8)

AUTHOR: Rudakov, V. P. SOV/89-[illegible]-18/25

TITLE: IX All-Union Conference on Nuclear Spectroscopy (IX Vsesoyuznoye soveshchaniye po yadernoy spektroskopii)

PERIODICAL: Atomnaya energiya, 1959, Vol 7, Nr [illegible], pp 76-[illegible] (USSR)

ABSTRACT: The IX All-Union Conference was held from January 26 to February 2, 1959 at Khar'kov. More than [illegible] participants heard 100 lectures, the most important of which dealt with the following fields. Nuclear Theory. General problems of [illegible]. A. S. Davydov (MGU): Theoretical classification of low-energy excited nuclear states. L. K. Peker: Deformed nuclei. [illegible] Birbrair, L. K. Peker, L. A. Sliv (LFTI): Quadrupole oscillations of deformed nuclei. Ye. V. [illegible], V. [illegible], S. P. Taytko (KhFTI): Calculation of the ft-values with matrix elements for β-transitions by means of the generalized nuclear model. S. T. Belyayev (IAE): Consideration of pair-correlation in nuclei. A. [illegible] (IAE): The application of the superconductivity model to nuclei for the purpose of calculating their moments of inertia. P. E. Nemirovskiy (IAE): Problems of the neutron stability of nuclei. [illegible] (IAE): The present stage in the theory of β-decay. [illegible], V. K. Grigor'yev, [illegible], [illegible] ([illegible]): Measurement of the angular correlation between electron and neutrino in the decay of the neutron. [illegible], [illegible] Nasarenko, [illegible] (LFTI): Measurement of the correlation between the transversal electron polarization and circular polarization of γ-quanta occurring in the decay of Sc^{46} and Co^{60}. Decay Schemes. γ-radiation of Nuclei. [illegible] Anufriyev, A. K. Valiter, Yu. V. [illegible], Ye. [illegible], A. N. L'vov, P. M. Tutakin, S. P. Tsytko, P. V. Sorokin, A. S. Deynako, I. Ya. Malakhov, [illegible] (Fiziko-tekhnicheskiy Khar'kovskiy institut (Physico-technical Institute, Khar'kov)): The $Si^{28,29,30}(p,\gamma)$, $Ne^{20}(p,\gamma)$, $S^{32,34}(p,\gamma)$, $Ar^{40}(p,\gamma)$ and $N^{14}(p,\gamma)$ reactions. D. G. Alkhazov, A. P. Grinberg, G. M. [illegible], M. Kh. Lemberg, V. V. Rozhdestvenskiy, [illegible] (Leningradskiy fiziko-tekhnicheskiy institut (Leningrad Physicotechnical Institute). Investigation of the Coulomb excitation of the lower levels of some nuclei during their bombardment by multiply charged ions (C, N, O, and Ne). A. V. Kalyamin, [illegible] Murin, V. N. Pokrovskiy, V. [illegible] ([illegible]): New isotopes Tu^{161}, Ho^{153}, Ho^{155} and $Er^{[illegible]}$. B. [illegible] Dzhelepov, [illegible] Sergiyenko (LGU): Decay schemes of some neutron-deficient isotopes, set up on the basis of measurements of the coincidence of the internal conversion electrons. Spectroscopy Engineering. B. S. Dzhelepov, [illegible], [illegible], V. G. Chumin (NIIAN): α-spectrometer with [illegible]. S. A. Baranov, [illegible], A. G. Zelenkov, A. [illegible], G. Ya. Shchepkin (IAE): Improved α-spectrometer. [illegible] Berchuk, [illegible], V. I. [illegible], [illegible] (IFAN UkrSSR): Magnetic spectrograph for heavy charged particles. The representatives of the Ministerstvo radiotekhnicheskoy promyshlennosti (Ministry of the Radio-engineering Industry) gave a report about new multipliers. The Conference was closed by B. S. Dzhelepov who stressed the fact that nuclear tables and reference works ought to be published much more quickly in order to be of real use to the experimenter.

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24(5)

AUTHORS: Puzikov, L. D., Smorodinskiy, Ya. A. SOV/56-36-5-54/76

TITLE: The Polarization Tensors in Born's Approximation (Tenzory polyarizatsii v bornovskom priblizhenii)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 5, pp 1585-1586 (USSR)

ABSTRACT: Various authors already repeatedly pointed out that the polarization of elastically scattered nucleons, calculated in first Born's approximation is equal to zero. In the present "Letter to the Editor" the authors investigate the polarization of particles with higher spin in Born's approximation and endeavor to derive a selection rule for the polarization states. They use the example of elastic scattering on a reaction of the type $a + a' \rightarrow b + b'$. If JM and J'M' denote rank and projection of the polarization tensors of the particles a and a', and if KN and K'N' denote rank and projection of the polarization tensors of b and b' respectively, two relations are derived for the coefficients, from which the selection rule may be obtained: $K^{JMJ'M'}_{KNK'N'} = 0$

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24(5), 21(8)
AUTHOR: Smorodinskiy, Ya. A. SOV/56-36-5-70/76

TITLE: The "Complete Experiment" in β-Decay ("Polnyy opyt" v β-raspade)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 5, pp 1606-1608 (USSR)

ABSTRACT: Together with Puzikov and Ryndin the author already determined the necessary number of experiments (the "complete experiment") for establishing the nucleon-nucleon scattering matrix (Ref 1). The results have already been generalized for particles of arbitrary spins (Ref 2) and for inelastic processes (Ref 3). In the present "Letter to the Editor" the author discusses the generalization for β-decay; only the decay of the neutron, with the β-interaction Hamiltonian $H_\beta = (V_\alpha + A_\alpha)\langle e|\gamma_\alpha(1+\gamma_5)|\nu\rangle$ is investigated, where V_α and A_α denote the nucleon "currents" (vectorial and pseudovectorial interaction). These two quantities are explicitly written down as functions of the four-momentum, the wave functions, and the

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form factors, and are discussed in detail especially with respect to the form factors. By these four functions a(k), ... d(k) all properties of β-decay of the neutron may be described. For each momentum value given four experiments are necessary in order to obtain information concerning β-decay. According to Gell-Mann the two form factors a(k) and b(k) in the case of light nuclei coincide with those of electron scattering on protons or neutrons, i. e. in this case two form factors, i. e. two experiments for each given momentum value will be found sufficient if the data of electron scattering are used. If charge invariance is disturbed, the number of necessary form factors in each case varies by one unit. For the transition I' → I"(no) the number of form factors in the expression for the vector current is 2I + 1, where I denotes the greater of the two spins I' and I", and for the pseudovectorial current it is 2I. In the transition I → I' (yes) the corresponding number of the form factors is I and 2I + 1; these figures are, of course, equal to the number of experiments necessary for the "complete experiment". The case of the forbidden transitions is

then briefly discussed and it is pointed out that the above considerations apply also to μ-capture. The author thanks R. Ryndin and S. Bilen'kiy for discussions. There are 7 references, 3 of which are Soviet.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: February 17, 1959

24 (5)

AUTHORS: Gol'danskiy, V. I., Smorodinskiy, Ya. A. SOV/56-36-6-60/66

TITLE: Singularities of the S-Matrix and the ρ^0-Meson (Osobennosti S-matritsy i ρ^0-mezon)

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 36, Nr 6, pp 1950 - 1951 (USSR)

ABSTRACT: In the introduction the authors discuss the possibilities of detecting the existence of a second neutral meson (ρ^0) with T = 0 and strangeness, and also discuss methods which have already been suggested (Refs 1-6). In the following, the π p scattering reaction at $E_\pi > 270$ MeV is investigated; the scattering cross section is assumed to have two kinds of singularities: a) singularities connected with the "isobaric" state, e.g. $\pi^+ + p \rightarrow$ "isobars" (T = 3/2, I = 3/2); the S-matrix has a pole in the complex plane, the cross section curve has the known resonance shape; b) the production threshold of a new particle e.g. $\pi^- + p \rightarrow \rho^0 + n$; (occurrence of a branching point on the material axis). In this case, which is further investi-

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gated, three kinds of discontinuities occur: "steps", "dips", and "peaks". The latter have a smaller width (order of magnitude 10 - 20 Mev) and a small probability, so that the observed maxima with T = 1/2 at pion energies of 680 - 940 Mev (according to D. Frish) were connected with a ϱ^0-production (ϱ_0-mass 1200 and 1520 m_e). Another possibility of distinguishing between resonance- and threshold singularities is based on a comparison between interactions in systems with different isotopic spin but with the same energies. An investigation of the magnitude of singularity makes it possible to estimate the upper limit of the possible production cross section of the ϱ^0-meson. The following holds:

$$2\left(\frac{\delta\sigma(\mathcal{E})}{\sigma(\mathcal{E})}\right)^2 = \left(\frac{\sigma(E_0+\mathcal{E})-\sigma_{thresh}}{\sigma_{thresh}}\right)^2 + \left(\frac{\sigma(E_0-\mathcal{E})-\sigma_{thresh}}{\sigma_{thresh}}\right)^2$$

E = threshold energy, σ = elastic cross section. It further holds that $\delta\sigma(\mathcal{E})/\sigma(\mathcal{E}) = (k/4\pi)\sigma_\varrho(\mathcal{E})/\sqrt{\sigma(\mathcal{E})}$; k is the pion wave vector, σ_ϱ the production cross section of the ϱ^0-meson at a

Singularities of the S-Matrix and the ζ^0-Meson SOV/56-36-6-60/66

pion energy of $E + \mathcal{E}$. These deliberations were made except by the authors of this paper also by Pontekorvo et al (Ref 7). There are 7 references, 5 of which are Soviet.

ASSOCIATION: Fizicheskiy institut im. P. N. Lebedeva Akademii nauk SSSR (Physics Institute imeni P. N. Lebedev of the Academy of Sciences, USSR). Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: April 4, 1959

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16.8100, 16.8300, 24.6000

76992
SOV/56-37-6-32/55

AUTHORS: Bilen'kiy, S. M., Ryndin, R. M., Smorodinskiy, Ya. A., Khe Tso-syu

TITLE: Theory of β-Decay of the Neutron

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, 1959, Vol 37, Nr 6, pp 1758-1763 (USSR)

ABSTRACT: Calculations were performed for corrections to various effects in β-decay of the neutron. The corrections originated from the account of terms for the electron and nucleon masses $\sim m/M$. These terms are due to the "weak Gell-Mann magnetism" and proton recoil. It was shown that for electron-neutrino correlation and the up-down symmetry of electrons, these corrections may reach several percent. Thus, the correction for the $(e-\nu)$-correlation for the total energy of electron of 0.71, 0.91, 1.11, 1.29 mev,

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Theory of β-Decay of the Neutron

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SOV/56-37-6-32/55

as compensated for "weak magnetism" and the recoil, was, respectively, as follows: 0.4, 1.4, 2.4, 3.3%, and 1.9, 2.7, 3.5, 4.2%. The correction to the asymmetry of electrons for the total energy of electron 0.71, 0.91, 1.11, 1.29 mev, as compensated for "weak magnetism" and the proton recoil, was found to be, respectively: 1.3, 1.8, 2.4, 3.0%, and 0.3, 0.5, 0.6, 0.8%. Corrections for the polarization were found to be small and at energies of 0.71, 0.91, and 1.11 mev were, respectively: 0.14, 0.08, and 0.07%, V. Telegdi participated in the discussion of this work. There are 2 tables; and 12 references, 1 Soviet, 1 Italian, 10 U.S. The 5 most recent U.S. references are: R. P. Feynman, M. Gell-Mann, Phys. Rev., 109, 193, 1958; M. Gell-Mann, Phys. Rev., 111, 362, 1958; J. Bernstein, R. R. Lewis, Phys. Rev., 112, 232, 1958; M. Morita, Bull. Am. Phys. Soc., 4, 230 D11, 1959; S. Weinberg, Phys. Rev., 112, 1375, 1958.

ASSOCIATION: Joint Inst. Nuclear Research, USSR (Ob'edinennyy institut

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SMORODINSKIY, Ya.A., prof.

Spatial structure of the atomic nucleus. Priroda 48 no.6:3-12 Je '59. (MIRA 12:5)

1.Ob"yedinennyy institut yadernykh issledovaniy.
(Nuclear physics)

21(8) SOV/53-67-1-4/12

AUTHOR: Smorodinskiy, Ya.

TITLE: The Present Stage of the Theory of β-Decay (Sovremennoye sostoyaniye teorii β-raspada)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 67, Nr 1, pp 43-98 (USSR)

ABSTRACT: The author gives a very detailed survey, which, in parts, amounts to a textbook, of the modern theory of β-decay. After a short historical introduction the following problems are dealt with by separate chapters: The Dirac (Dirak) equation, the two-component neutrino, the parity (P,T,C), the possible kinds of β-interaction (Table), the spectrum of allowed transition and the electron-neutrino correlation, the polarization of electrons, the decay of polarized nuclei (Table), the polarization of the nucleus after decay and the β-γ-correlation, the theory of V-A interaction, and, finally, experimental data concerning the nature of β-interaction (absence of interference terms, $e\nu$-correlation, decay constants, the conservation of the neutrino charge, the helicity of the neutrino, the helicity of the electrons, the decay of polarized nuclei, the correlation between e and γ-polarization, the conservation of combined parity.

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The Present Stage of the Theory of β-Decay SOV/53-67-1-4/12

The material used is, for the greater part, taken from Western publications. The following publications by Soviet authors are mentioned:
Surveys: Ya. B. Zel'dovich, S. Yu. Luk'yanov, Ya. A. Smorodinskiy; nonconservation of parity in β-decay: L. Joffe, A. P. Rudik, L. B. Okun'; L. D. Landau, I. S. Shapiro, A. Sokolov, V. B. Berestetskiy, K. A. Ter-Martirosyan, Yu. V. Gaponov, V. S. Popov, A. Z. Dolginov, V. V. Anisovich, A. A. Ansel'm, B. V. Ishkin, S. E. Nemirovskaya; basic experiments not connected with the nonconservation of parity: P. Ye. Spivak, A. N. Sosnovskiy, A. Yu. Prokof'yev, V. S. Sokolov (lecture in Geneva 1955), A. N. Sosnovskiy, Yu. A. Prokof'yef (sic), I. Ye. Kutikov, Yu. P. Dobrynin (lecture in Geneva 1958; half-life of the neutron: 11.7±0.3 sec.), N. A. Burgov and Terekhov (lecture in Geneva, 1958, $e\nu$-correlation); properties of the neutrino: Ye. I. Dobrokhotov, V. R. Lazarenko, S. Yu. Luk'yanov (Ca^{48} has no 2β-decay); electron polarization: A. I. Alikhanov, G. P. Yeliseyev, A. V. Lyubimov, B. V. Ershler, M. Ye. Vishnevskiy, B. K. Grigor'yev, V. A. Yermakov, S. I. Nikitin,

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The Present Stage of the Theory of β-Decay SOV/53-67-1-4/12

Ye. V. Pushkin, Yu. V. Trebukhovskiy. There are 2 tables and 222 references, 26 of which are Soviet.

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21(8)
AUTHOR: Smorodinskiy, Ya. A.

SOV/53-68-4-3/12

TITLE: β-Decay and Weak Interactions
(β-raspad i slabyye vzaimodeystviya)

PERIODICAL: Uspekhi fizicheskikh nauk, 1959, Vol 68, Nr 4, pp 653-662 (USSR)

ABSTRACT: This is the reproduction of a lecture held by the author at the 9. All-Union Conference on Nuclear Spectroscopy in January 1959 at Khar'kov. In it he gives a survey of the latest developments (since Yang and Lee) in this field. In the introduction the most prominent scientists working in this field are listed (besides Yang and Lee, Fermi, Landau, Gell-Mann, Feynman et al.), and the results they obtained by investigations are briefly described. Next, the most simple case of muon decay is dealt with; the interaction Hamiltonian is given, and the constant g_μ characterizing "longitudinal" interaction is given as amounting to $(1.38\pm0.02)\cdot10^{-43}$ erg/cm^3. In a similar manner the β-decay of the neutron is dealt with, and $g_\beta = (1.41\pm0.01)\cdot10^{-49}$ erg/cm^3 is given. In the following, the author compares these β-interactions with the interaction between nucleons and the

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electromagnetic field, after which he passes on to other processes with weak interaction (pion decay in electron and neutrino, muon capture of the neutron, β-decay of the hyperons, K-meson decay, etc.). He then passes on to the theory of interaction, and, proceeding from the current equations:

$j = (\bar{e}\Gamma\nu) + (\bar{\mu}\Gamma\nu) + (\bar{n}\Gamma p) + (\bar{\Lambda}\Gamma p)$ and

$j^{+} = (\bar{\nu}\Gamma e) + (\bar{\nu}\Gamma\mu) + (\bar{p}\Gamma n) + (\bar{p}\Gamma\Lambda)$, the following valuable scheme is set up:

j^{+} \ j	$(\bar{e}\Gamma\nu)$	$(\bar{\mu}\Gamma\nu)$	$(\bar{n}\Gamma p)$	$(\bar{\Lambda}\Gamma p)$
$(\bar{\nu}\Gamma e)$	$\nu+s \longrightarrow \nu+e$			
$(\bar{\nu}\Gamma\mu)$	$\mu \longrightarrow e+\nu+\tilde{\nu}$	$\nu+\mu \longrightarrow \nu+\mu$		
$(\bar{p}\Gamma n)$	$n \longrightarrow p+e+\tilde{\nu}$ $\pi \longrightarrow e+\tilde{\nu}$	$p+\mu \longrightarrow n+\nu$ $\pi \longrightarrow \mu+\nu$	$p+n \longrightarrow p+n$	
$(\bar{p}\Gamma\Lambda)$	$\Lambda \longrightarrow p+e+\nu$ $K \longrightarrow e+\tilde{\nu}$	$\Lambda \longrightarrow p+\mu+\tilde{\nu}$ $K \longrightarrow \mu+\tilde{\nu}$	$\Lambda \longrightarrow K+p$	$\Lambda+p \longrightarrow \Lambda+p$

This scheme is discussed. Finally, questions relating to the nonconservation of parity and three kinds of experiments are discussed, from the results of which an evaluation of the upper limits of the possible admixtures of states may occur in the case of the nonconservation of parity: 1) Measurement of the longitudinal polarization of neutrons in their scattering by nuclei at an angle of 0° (admixture $\sim 4.10^{-6}$). 2) The production of pions by polarized protons, parallel and antiparallel to the polarization vector (admixture $< 2.10^{-7}$). 3) Investigation of the disturbance of parity in nuclear reactions at low energies (admixture $< 5.10^{-3}$). Theoretical questions relating to such evaluations are discussed. There are 3 figures, 1 table, and 14 references, 2 of which are Soviet.

SMORODINSKIY, Ya.A., prof.

Antiparticles - antimatter - antiworlds. Priroda no.6: 15-22 Je '60. (MIRA 13:6)
(Particles(Nuclear physics))

SMORODINSKIY, Ya.A.; KHE TSZO-SYU

Radiative corrections in the processes of weak interaction.
Zhur.eksp.i teor.fiz. 38 no.3:1007-1008 Mr '60.
(MIRA 13:7)

1. Ob"yedinennyy institut yadernykh issledovaniy.
(Mesons)

S/053/60/070/02/009/016
B006/B007

AUTHORS: Lebedev, R., Smorodinskiy, Ya., Tyapkin, A.

TITLE: The Physics of Elementary Particles 19

PERIODICAL: Uspekhi fizicheskikh nauk, 1960, Vol 70, Nr 2, pp 361-374 (USSR)

ABSTRACT: The authors give a report on the International Conference on High Energy Physics held at Kiyev in July 1959. This report is interesting above all because of the voluminous material of the work carried out at Dubna (USSR). The Conference was attended by about 150 delegates from Eastern Block countries, and by about the same number from other countries. As regards organization, the Conference introduced a novel arrangement which essentially consisted in the fact that "reporters" and "scientific secretaries" were attached to the lecturers, and that the lectures could be heard in Russian and in English. The secretaries were in all cases well-known Russian physicists. Leading physicists acted as chairmen of the plenary sessions; the Russian chairmen were

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D. I. Blokhintsev and I. Ye. Tamm. Two of the seven holders of the Nobel Prize represented were Russians: I. Ye. Tamm and P. A. Cherenkov. Apart from the surveying lectures seminars were held, in which the following Russian lecturers spoke: I. Ye. Tamm on "Diagram Technique and Field Theory", D. D. Ivanenko on the "Nonlinear Field- and Gravitation Theory", V. P. Dzhelepov on "Nucleon-Nucleon Collisions", and I. V. Chuvilo on "Bubble Chambers". The plenary sessions began on July 20. In the first session Bernardini (CERN) spoke. His scientific secretaries were A. Baldin and A. Belousov (Moscow). The report on the lecture mentions the data obtained at the Fizicheskiy institut im. P. N. Lebedeva AN SSSR (Physics Institute imeni P. N. Lebedev AS USSR) on the "Polarizability of Protons in (γp)-Collisions". B. Pontekorvo (Dubna) delivered a lecture, which is discussed here in detail, on "Pion Scattering by Nucleons and Production of Single Pions in Nucleon-Nucleon and Pion-Nucleon Interactions"

(Scientific Secretaries A. Mukhin, Yu. Prokoshkin, and L. Soroko (Dubna)). First, he gave a survey of new experimental data contributing towards explaining the problem of the charge-independence of pion- and nucleon processes, and further data concerning the search for the ϱ^0-meson, and details concerning new work relating to pion angular distribution. Investigations of single pion production in (nn)-collisions resulted in experimental agreement with the phenomenological theory of Mandel'shtam, which demands that π-n-resonance interactions occur in a state with isotopic spin $T = 3/2$. In the following lecture by Segrè, M. Shafranov and V. Shakhbazyan (Dubna) acted as scientific secretaries. Next, V. I. Veksler (Dubna) spoke about "Nucleon-Nucleon and Pion-Nucleon Interactions in the 1.5 - 10 Bev Range" (Scientific Secretaries: N. Bogachev, V. Grishin, and M. Podgoretskiy (Dubna)). He delivered a report on the investigations carried out in the past years in Dubna and made a comparison with theoretical results. Figure 1 shows the photograph supplied by him of the production and the decay of Λ^0 and anti-Λ^0-

hyperons. Investigations of the (pp)-scattering cross section yielded new results indicating that the scattering amplitude in the optical model has not only an imaginary- but also a real part. New data were obtained at Dubna also for the total elastic and inelastic (pp)- and (πp)-scattering cross sections at 9 and 7 Bev, respectively. Investigations carried out by I. Ye. Tamm are mentioned. In the following, Ya. A. Smorodinskiy (Dubna) spoke about (nn)-scattering (Scientific Secretaries B. Golovin (Dubna) and L. Puzikov (Moscow)) and Chew (Secretaries: L. Lapidus (Dubna) and Yu. Novozhilov (Moscow)). At Dubna proton accelerations to 635 Mev are possible. At the following three surveys on electromagnetic interaction and nucleon structure A. Varfolomeyev and L. Solov'yev (Moscow) as well as S. Bilen'kiy and B. Barbashov (Dubna) acted as scientific secretaries. There followed a lecture delivered by Steinberger, whose scientific secretaries were E. Okonov and R. Rvndin (Dubna). The lecturer Alvarez was assisted by the secretaries A. Lyubimov and

N. Petukhova (deceased) (Dubna), and Salam by the secretaries B. Valuyev and V. Solov'yev (Dubna). A special session of the Conference dealt with the problem of dispersion relations. D. V. Shirkov (Dubna), spoke about the theory (secretaries: V. Vladimirov and A. Logunov); the second lecture dealing with this subject was delivered by Lehmann (secretaries: V. Favnberg and O. Parasyuk (Moscow)). A further special session dealt with theoretical single reports ("New Theoretical Ideas"). Among others, Landau spoke about diagram technique, Garibyan (Yerevan) on the radiation of relativistic particles in the passage through the boundary between two media. Two further lectures dealt with weak interaction problems: A. A. Alikhanov (Moscow) (experimentally) and R. Marchuk (theoretically); the scientific secretaries were B. Ioffe and V. Lyubimov, and L.Okun' and I. Shapiro(Moscow) respectively. At Dubna the muon precession in the magnetic field was investigated, and direct proof was supplied for the first time that muon spin is half-integral. The group of research scientists at Dubna further succeeded in proving the radiationless muon capture by heavy

nuclei (nuclear excitation), as predicted by Zaretskiy (Moscow). During the following lecture delivered by Glaser, I. Kobzarev acted as scientific secretary and during that delivered by Powell, I. Gramenitskiy (Dubna), Y. Maksimenko (Moscow), and V. Kharitonov (Yerevan). A survey on the theory of multiple production of particles in the case of ultra-high energies was finally delivered by Ye. L. Feynberg (Moscow), D. Chernavskiy (Moscow) and V. Barashenkov (Dubna) acting as his scientific secretaries. During the Conference the delegates paid a visit to the Institut fiziki AN USSR (Institute of Physics of the AS UkrSSR) at Kiyev, after which many foreign delegates visited Dubna. There are 4 figures.

SMORODINSKIY, Ya. A. and PONTECORVO, Bruno M.

"Neutrino Component of Cosmic Rays and Cosmological Considerations."

report presented (by L. D. Puzikov) at the IUPAP sponsored Intl. Conf. on Theoretical Aspects of Very High Energy Phenomena, CERN Headquarters, Geneva, 5-9 June 1961.

SMORODINSKIY, Ya.; HU SHIH-KO

Radiative corrections in pion decays. Dubna, Izdatel'skii otdel Ob"edinennogo in-ta iadernykh issledovanii, 1961. 8 p.
(No subject heading)

SMORODINSKIY, Yakov Abramovich, prof., doktor fiz.-matem.nauk; FAYNBOYM, I.B., red.; SAVCHENKO, Ye.V., tekhn.red.

[What we know about elementary particles] Chto my znaem ob elementarnykh chastitsakh. Moskva, Izd-vo "Znanie," 1961. 46 p. (Vsesoiuznoe obshchestvo po rasprostraneniiu politicheskikh i nauchnykh znanii. Ser.9, Fizika i khimiia, no.4). (MIRA 14:3)

(Particles (Nuclear physics))

SMORODINSKIY, Ya.A.

PHASE I BOOK EXPLOITATION SOV/5982

International Conference on High-Energy Physics. 9th, Kiyev, 1959.

Devyataya mezhdunarodnaya konferentsiya po fizike vysokikh energiy, Kiyev 15-25 iyulya 1959 g. (Ninth International Conference on High-Energy Physics. Kiyev, July 15-25, 1959), Moscow, 1961. 739 p. 2,500 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Mezhdunarodnyy Soyuz chistoy i prikladnoy fiziki.

Contributors not mentioned.

PURPOSE: This book is intended for nuclear physicists.

COVERAGE: The collection contains 30 scientific articles presented at the 9th International Conference on High-Energy Physics, held in Kiyev from 15 to 25 July 1959. The articles presented relate mainly to the progress in nuclear physics achieved in 1959. Subjects discussed are the production of

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Ninth International Conference (Cont.) SOV/5982

nucleons, their structure, weak and strong interactions, scattering, and their decay. No personalities are mentioned. References accompany individual articles.

TABLE OF CONTENTS:

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SMORODINSKIY, Ya.A., doktor fiziko-matematicheskikh nauk

Geometry of the universe. Nauka i zhizn' 28 no.12:60-64 D '61.
(MIRA 15:2)

(Relativity (Physics))

BADALYAN, A.M.; SMORODINSKIY, Ya.A.

Weizsacker-Williams relation for matrix elements. Zhur. eksp. i teor. fiz. 40 no.4:1231-1233 Ap '61. (MIRA 14:7)
(Bremsstrahlung) (Matrices)

26422
S/056/61/041/001/017/021
B102/B231

24.6610

AUTHORS: Pontekorvo, B., Smorodinskiy, Ya.

TITLE: The neutrino and the density of matter in the universe

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 1(7), 1961, 239 - 243

TEXT: No estimations regarding the neutrino-antineutrino density in the universe have hitherto been made; there is, however, reason to believe that it is remarkable, due to the fact that these particles are hardly absorbed in dense matter. The authors now raise the question: Is it possible that the energy pertaining to the neutrinos and antineutrinos is comparable with or greater than the energy corresponding to the rest mass of hydrogen? It was the aim of the present investigations to find an answer to this question. The assumption of a high neutrino antineutrino energy density is not incompatible with available experimental data, but these depend essentially on the cosmological model. Some methods are now discussed, which might help to verify this assumption,

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which is in itself a consequence of the PC asymmetry of the universe and of the hypothesis of the existence of antiworlds. The methods referred to consist preponderantly in investigating cosmic radiation and its interaction with matter, as well as the well-known experiment carried out by Reines, Cowan, and Davis with a reactor. They confirm the existence of anti-neutrinos with energies varying from 3 to 8 Mev. The tests showed that the flux of antineutrinos exhibiting energies from 3 to 10 Mev is not likely to exceed the value 10^{3} cm^{-2} sec^{-1} essentially in the cosmic space. This corresponds to a maximum energy density of antineutrinos of these energies amounting to $\sim 10^{3}$ Mev/cm ^{3}. These experiments supply, however, no information on the $\tilde{\nu}$ density if $E_{\nu} \gg 10$ Mev. The Davis experiments disclosed that the cosmic neutrino density (neutrinos exhibiting energies of several Mev) cannot exceed some 10 Mev/cm^{3}. Estimating the density of neutrinos exhibiting energies of up to 100 Mev supplies a few Mev/cm^{3} with regard to the order of magnitude, and exceeds by far the maximum energy density of hydrogen ($W_{H}^{max} \sim 10^{2}$ Mev/cm^{3}) in the universe. For ν and $\tilde{\nu}$ exhibiting energies of ~ 1 Bev, an energy

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density of $\lesssim 10^{-1}$ Mev/cm is obtained, which is comparable with W_H^{max}. In this connection, it is important to take the meaning of the $(e\nu)$ $(e\bar{\nu})$ Fermi interaction into account, which guarantees an energy transfer to the $\nu\bar{\nu}$ component. Attention is drawn to the fact that the small magnitude of the "visible" kinetic-energy density (which is many smaller than the energy density corresponding to the rest mass of the nucleons) is not contradictory to the hypothesis of separation of matter from anti-matter as a result of fluctuations occurring in a charge-symmetrical universe. The fluctuation hypothesis only presupposes the assumption that once in the past the $\nu\bar{\nu}$ energy density exceeded the nucleon-energy density by several orders of magnitude. The authors thank A. G. Masevich and S. B. Pikel'ner for discussions. There are 5 references: 5 Soviet-bloc and 9 non-Soviet-bloc. The most important references to English language publications read as follows: H. Y. Chiu, R. Stabler. Neutrino Emission Processes and Stellar Evolution, preprint, 1960; F. Reines, C. L. Cowan. Proc. of the 2-nd Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 1958; R. Davis. Bull. Amer. Phys. Soc. 4, 217, 1959; G. E. P. George, I. Evans. Proc. Phys. Soc. A 61, 148 1950; A 64,

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26422

The neutrino and the density ...

193, 1951; T. D. Lee, L. N. Yang, Phys. Rev. Lett., 4, 307, 1960; N. Gabbibo, R. Gatto, Nuovo Cim., 15, 304, 1960.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: February 7, 196

Card 4/4

28763
S/056/61/041/003/016/020
B125/102

24.6610 (1057, 1538)

AUTHORS: Zel'dovich, Ya. B., Smorodinskiy, Ya. A.

TITLE: The upper limit of neutrino, graviton, and baryon density in the universe

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 41, no. 3(9), 1961, 907-911

TEXT: To estimate the maximum energy density of neutrinos, gravitons and baryons in the universe the gravitational effect of these particles on the expanding universe has been investigated by the authors. According to B. M. Pontekorvo and Ya. A. Smorodinskiy (ZhETF, 41, 239, 1961) it is very difficult to determine the cosmic neutrino density. Direct tests have shown that the mass-energy density in the form of neutrinos may be 10^4 to 10^5 times higher than the rest-mass-energy density in an ordinary form. The authors, and also F. Reines, have already shown that these estimates depend on hypotheses concerning the neutrino spectrum. Another method for calculating the maximum energy density is based on determining the gravitational effect and fits all unknown, weakly interacting fields, also

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for the density of high-frequency oscillations of the gravitational field (gravitons). According to G. M. Gandel'man and V. S. Pinayev (ZhETF, 37, 1072, 1959), the bremsstrahlung of gravitons is 10^{10} times smaller than the radiation of ν-$\bar{\nu}$ pairs. For the suggested estimate, the density ϱ of all kinds of matter-energy determines the past of the universe. The critical density ϱ_k of the matter-energy, which has been introduced by the authors, characterizes the transition from an open to a closed model of the universe: at $\varrho < \varrho_k$, the expansion will last for an unlimited time; at $\varrho > \varrho_k$, however, this expansion will change over into contraction. The times T counted from the instant of maximum density of the universum until now are as follows:

$$\tau = k^{-2}[(k + k^{-1})\operatorname{arctg} k - 1], \qquad k = (2q - 1)^{1/2};$$

$$\tau' = [1 + (2q)^{1/2}]^{-1}.$$

$q = \varrho/2\varrho_k$, τ is calculated for resting matter and a pressure $p = 0$; τ' is calculated according to L. D. Landau for negligible rest mass, i.e., for particles moving at velocity of light and $p = \varepsilon/3$ (ε denotes the energy

The upper limit of neutrino ...

density). For $T_0 = 10^{10}$ years, one obtains $r > 0.4$ and, therefrom, $q < 5$ and $\varrho < 2 \cdot 10^{-28}$ g/cm^3. An independent investigation yields $q < 10$ for distant galactics systems. Equal results are obtained on a third estimate of the maximum density by studying the star density in the galaxies. It is possible that the density of neutrinos, gravitons, etc., in the universe is higher than the mean nucleon density observed (10^{-29} g/cm^3) but more than 10 to 20 times. The similarity of $\varrho = 10^{-29}$ g/cm^3 for ordinary matter suggested a comparatively young age of the universe. At equal order of magnitude of neutrino mass and nucleon mass densities, the value for the density will be smaller than $\sim 10^{-29}$ g/cm^3, and correspond to $\sim 10^{-5}$ nucleons per cm^3. The number of nucleons may be much larger than the given value since the gravitational mass defect ΔM of a star after the gravitational collapse may be of the same order of magnitude as the sum of the rest masses of the nucleons contained in the star. At present, there is no correct theory on gravitational collapses. L. D. Landau and Ye. M. Lifshits have estimated the critical mass to be 76% of the solar mass. When a gravitational collapse of a star occurs, the energy might be emitted in the form of neutrinos and antineutrinos. The mean nucleon

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The upper limit of neutrino ...

density in collapsed stars will be no more than 10 [illegible] times higher than known densities of ordinary nucleons. All these estimates are only correct for not too early collapses. There are [illegible] references: 9 Soviet and 6 non-Soviet. The four most recent references [illegible] English-language publications read as follows: F. Reines, C. L. Cowan, Jr., F. B. Harrison, A. D. McGuire, H. W. Kruse, Phys. Rev., [illegible], 59, 1960; H. Y. Chin, P. Morrison. Phys. Rev. Lett., 5, [illegible] M. Gell-Mann. Phys. Rev. Lett. 6, 70, 1961. F. Hoyle. Prog. Theor. Phys. Suppl., [illegible], 1, 1961.

SUBMITTED: April 14, 1961

Card 4/4

SMORODINSKIY, Ya. A.

"Multipole Expansions in Field Theory"

report presented at the Intl. Conference on High Energy Physics, Geneva, 4-11 July 1962

Joint Institute for Nuclear Research
Laboratory of Theoretical Physics, Dubna, 1962

KLEPIKOV, N.P.; SMORODINSKIY, Ya.A.; ZARUBINA, I.S. [translator]; SARANTSEVA, V.R., tekhn. red.

Inversion of helicity in nuclear reactions. Dubna, Ob"edinennyi in-t iadernykh issledovanii, 1962. 8 p.
(No subject heading)

SMORODINSKIY, Ya.A.

[Kinematics and Lobachevskii geometry] Kinematika i geometriia Lobachevskogo. Dubna, Ob"edinennyi in-t iadernykh issledovanii, 1962. 21 p. (MIRA 16:10)
(Kinematics) (Geometry, Non-Euclidean)

SMORODINSKIY, Yakov Abramovich; LESHKOVTSEV, V.A., nauchnyy red.; SHUSTOVA, I.B., red. izd-va; ATROSHCHENKO, L.Ye., tekhn. red.

[Elementary particles] Elementarnye chastitsy. Moskva, Izd-vo "Znanie," 1962. 45 p. (Narodnyi universitet kul'tury: Estestvennonauchnyi fakul'tet, no.1) (MIRA 15:5)
(Particles (Nuclear physics))

35571
S/056/62/042/003/033/049
B102/3138

AUTHORS: Lyuboshits, V. L., Smorodinskiy, Ya. A.

TITLE: Covariant expansion of the electromagnetic field

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 3, 1962, 846 - 856

TEXT: Two problems of covariant expansion of a free electromagnetic field are considered: a) expansion of a photon field with respect to electric and magnetic multipoles, b) expansion of field sources (current) with respect to multipole moments. The formulas are derived by using the irreducible tensors of the Lorentz group and the conception of the "little group" L_q of the four-vector q which is assumed to be time-like or lying on the light cone. In the first case L_q is an isomorphous subgroup of spherical symmetry. For the momentum k lying on the light cone, the little group L_k is an isomorphous space group for the biatomic molecule considered. After defining the covariant Stokes parameters, expressions for the covariant expansion of the photon field with respect to the

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Covariant expansion of the...

multipoles $$E_{LM}(k) = L^{-1/2}(L+1)^{-1/2}|k|\nabla_k Y_{LM}(n),$$
$$M_{LM}(k) = L^{-1/2}(L+1)^{-1/2} i[k\nabla_k] Y_{LM}(n). \quad (15)$$

where
$$kE_{LM}(k) = 0, \quad kM_{LM}(k) = 0, \quad \nabla_k M_{LM}(k) = 0,$$
$$E_{LM}(k) M_{LM}(k) = 0 \quad (16)$$

are derived.

$$E^{(l)}_{mLM}(k) = L^{-1/2}(L+1)^{-1/2} \frac{1}{\sqrt{-P^2}} \left[k_m \left(P_n \frac{\partial}{\partial k_n} \right) - (kP) \frac{\partial}{\partial k_m} \right] Y^{(l)}_{LM}(n), \quad (25)$$

$$M^{(l)}_{mLM}(k) = \frac{1}{i\sqrt{-P^2}} L^{-1/2}(L+1)^{-1/2} e_{mlst} k_l \left(\frac{\partial}{\partial k_s} Y^{(l)}_{LM}(n) \right) P_t. \quad (26)$$

are obtained, which, if $\vec{P} = 0$, go over to (15) again. The expansion with respect to multipoles of the Fourier components of the electromagnetic field reads

$$A_m(k) = \sum_{LMl} e^{(l)}_{LM} E^{(l)}_{mLM}(k) + \sum_{LMl} m^{(l)}_{LM} M^{(l)}_{mLM}(k) \quad (27)$$

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The functions $Y^{(i)}_{L\mathcal{M}}(n)$ are tabulated for M = 0, ±1, ±2 and L=0,1,2. e_L and m_L are spinors with L dotted and L non-dotted indices. The covariant expansion of a charged-particle current with respect to multipole moments is achieved by a power expansion of

$$j_k(x, t) = \sum_i' e_{(i)} v_{(i)k} \delta^3 (x - x_{(i)}(t)), \tag{29}$$

$$\partial j_k(x, t)/\partial x_k = 0. \tag{29a}$$

and separation into current and charge density component:

$$j_k(x, t) = \sum_i e_{(i)} \dot{\xi}_{(i)k} \exp[-(\xi_{(i)}\nabla)]\, \delta^3(x) \tag{31}$$

$$(\dot{\xi}_{(i)} = \partial \xi_{(i)}/\partial t)$$

$$j = \sum_i \{ \quad + e_{(i)}\dot{\xi}_{(i)} \quad - e_{(i)}\dot{\xi}_{(i)}(\xi_{(i)}\nabla) \quad + \cdots \} \delta^3(x), \tag{32}$$

$$\rho = \sum_i \left\{ e_{(i)} - e_{(i)}(\xi_{(i)}\nabla) + \tfrac{1}{2} e_{(i)}(\xi_{(i)}\nabla)^2 - \cdots \right\} \delta^3(x). \tag{33}$$

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B102/B138

Covariant expansion of the...

For the particle trajectories $\vec{x}_{(i)}(t) = \vec{x}_c + \vec{\xi}_{(i)}(t)$ is valid. With

$$\sum_i \frac{1}{L!} \xi_{(i)\alpha} \xi_{(i)\beta} \ldots \xi_{(i)\gamma} = Q^{(L)}_{\alpha\beta\ldots\gamma}(t). \qquad (34)$$

for the charge density expansion with respect to multipole moments

$$\rho = \sum_L (-1)^L Q^{(L)} \nabla^L \delta^3(x), \qquad (35)$$

is obtained; ∇^L stands for the L-fold product $\nabla_\alpha \nabla_\beta \ldots$. For the current

$$(\alpha, \beta, \gamma = 1, 2, 3)$$

$$j_\alpha = \left\{ \sum_{L=1}^{\infty} (-1)^{L-1} \frac{\partial}{\partial t} Q^{(L)}_{\alpha\beta\gamma\ldots} \underbrace{\nabla_\beta \nabla_\gamma \ldots}_{L-1} + \right.$$

$$\left. + \sum_{L=2}^{\infty} \sum_i \frac{L-1}{L!} e_{(i)} (\xi_{(i)} \nabla)^{L-2} (-1)^L [\dot{\xi}_{(i)} \xi_{(i)}] \nabla]_\alpha \right\} \delta^3(x). \qquad (42)$$

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results. If the four-vector of current density is divided into an electrical and magnetic part,

$$j_l^{\text{эл}} = \left[ZP_l + \frac{\partial}{\partial x_k}(P_k N_l - P_l N_k) \right] P_0^{-1} \delta^3 [\mathbf{x} - \mathbf{x}_c(t)], \qquad (47)$$

$$\mathbf{x}_c(t) = \mathbf{P}t / P_0, \qquad j_l^{\text{м}} = -\varepsilon_{lklm} M_k P_l \frac{\partial}{\partial x_m} P_0^{-1} \delta^3 [\mathbf{x} - \mathbf{x}_c(t)]. \qquad (48)$$

are obtained. Finally, multipole radiation is considered and expressions are derived which relate the multipole expansions (25)(26) with the current density expansion with respect to the multipole moments. There are 1 table and 14 references: 8 Soviet and 6 non-Soviet. The three references to English-language publications read as follows: L. Michel, H. Rouhaninejad. Phys. Rev. 122, 242, 1961; D. M. Fradkin, R. H. Good. Rev. Mod. Phys. 33, 343, 1961; V. Bargmann, E. P. Wigner. Proc. Nat. Acad. Sci. USA, 34, 211, 1948.

SUBMITTED: October 6, 1961

Card 5/5

S/056/62/042/005/017/050
B102/B104

84 1660

AUTHORS: Baz', A. I., Puzikov, L. D., Smorodinskiy, Ya. A.

TITLE: Reconstruction of the scattering matrix near the threshold conditions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 42, no. 5, 1962, 1249-1251

TEXT: As a development of work previously reported (A. I. Baz', ZhETF, 33, 923, 1957) the authors present an analysis of the scattering data for spinless particles close to the reaction threshold in terms of a "complete experiment". The amplitude and cross-section of scattering near the threshold can be represented by the first few terms in a series expansion of the threshold quantities. The data required for the scattering matrix can be derived from measurements of the dependence of the polarisation quantities on the energy, in respect of elastic scattering near the threshold. For e.g. scattering of a 1/2-spin particle from a zero-spin particle, the elastic-scattering matrix near the reaction threshold is given by

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S/056/62/043/006/035/067
B125/B102

AUTHORS: Klepikov, N. P., Smorodinskiy, Ya. A.

TITLE: Chirality inversion in nuclear reactions

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 6 (12), 1962, 2173-2178

TEXT: The scattering matrix $M \to (\vec{\sigma}\vec{n}_f)\, M\, (\vec{\sigma}\vec{n}_i)$ of the transformation $\delta(l-j-1/2) \rightleftarrows -\delta(l-j+1/2)$ by S. Minami (Prog. Theor. Phys., 11, 213, 1954) can be written as $M \sim U^+(\vec{n}_f)MU(\vec{n}_i)$. Here $\vec{n}_i$ and $\vec{n}_f$ are the unit vectors in the directions of the incident and the scattered particle in the center-of-mass system. This transformation changes the sign of the transverse polarization of the particles, is anticommutates with the spatial reflexion $P(\vec{\sigma}\vec{n}) = -(\vec{\sigma}\vec{n})P$ and satisfies also the unitary condition $i(\vec{M}^+ - \vec{M}) = 2k\vec{M}^+\vec{M}$, which remains valid when $\vec{M} \to -\vec{M}^+$. $\vec{M} \to -\vec{M}$ corresponds to the change of signs of all phases, this comprises the change of signs, the transition to the hermitean-adjoint matrix in the spin space and the

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Chirality inversion in nuclear ...

exchange of the final and the initial momentum. The successive rotation of all spins through π around the momenta and the transformation (7) furnishes the chirality inversion of all particles. For particles with spin 1/2 the chirality inversion reduces itself to $\delta(l=j-1/2) \rightleftarrows -\delta(l=j+1/2)$ (L. D. Puzikov et al., ZhETF, 32, 592, 1957). By modifying the operators, these considerations can be generalized for particles with arbitrary spin. For particles having the arbitrary spin S the operator $U(\vec{n})$ goes over into $\exp[i(\vec{S}\,\vec{n})\pi]$. In systems with several particles the inversion chirality must be made for each single particle. By contrast with systems having half-integral spin, the Minami transformation and the chirality inversion do not change the parity of states in systems having integral spin. The remaining ambiguities can be removed by determining the sign of the longitudinal polarization (by measuring the pseudoscalar $(\vec{S}\vec{n})$, when an electric or magnetic field is applied or by investigating the energy dependence of the effects). Invariance of the observed values with respect to the transformation $M \rightarrow -U^{+}MU$ is removed with multiple scattering owing to the Thomas precession of spins.

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Chirality inversion in nuclear ... S/056/62/043/006/035/067
B125/B102

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research); Moskovskiy gosudarstvennyy universitet (Moscow State University)

SUBMITTED: June 22, 1962 (initially)
July 12, 1962 (after revision)

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44238

S/056/62/043/006/043/067
B104/B102

AUTHOR: Smorodinskiy, Ya. A.

TITLE: The translation of spin in the Lobachevski space

PERIODICAL: Zhurnal eksperimental'noy i teoreticheskoy fiziki, v. 43, no. 6(12), 1962, 2217 - 2223

TEXT: An attempt is made to work out a spin transformation scheme which deviates as little as possible from the ordinary nonrelativistic theory. It is based on the idea that reactions and decays can be so described that when a change of system occurs the spin is not transformed by the Lorentz group but by a translation on a hyperboloidal surface (imaginary sphere) in the velocity space, i.e. by a Foldy-Wouthuysen group that is isomorphous to the three-dimensional group of rotations. Hence, in an arbitrary coordinate system, the spin vector must be represented as a three-dimensional vector. For this purpose, the author used the Lobachevski geometry in the velocity space, in which the spin transformation is a translation of the spin vector along a geodesic on the hyperboloid (pseudo-Euclidean metric). The theory of the relativistic spin is thus considerably simplified: If

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SMORODINSKIY, Ya.A., prof.

Structure of a nucleon; experiments of Robert Hofstadter.
Priroda 51 no.3:101-103 Mr '62. (MIRA 15:3)

1. Ob"yedinennyy institut yadernykh issledovaniy, Dubna.
(Hofstadter, Robert, 1915-) (Nucleons)

SMORODINSKIY, Yakov Abramovich; FAYNBOYM, I.B., red.; RAKITIN, I.T., tekhn. red.

[Geometry of the universe]Geometriia Vselennoi. Moskva, Izd-vo "Znanie," 1963. 47 p. (Novoe v zhizni, nauke, tekhnike. IX Seriia: Fizika i khimiia, no.4) (MIRA 16:3)
(Cosmogony)

S/089/63/014/001/012/013
B112/B180

AUTHOR: Smorodinskiy, Ya. A.

TITLE: Kinematics and Lobachevskiy's geometry

PERIODICAL: Atomnaya energiya, v. 14, no. 1, 1963, 110-121

TEXT: In 1909 F. Klein found that the velocity space of the special theory of relativity was a Lobachevskiy space. In the present paper the author interpretes the kinematics of some objects of modern physics (particles with vanishing mass, spin particles etc.) in the light of the hyperbolic geometry of their velocity spaces. There are 12 figures.

SUBMITTED: October 1, 1962

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L 10213-63
ACCESSION NR: AP3000060

radiative corrections are included. This fact is also a consequence of the Gamma-sub 5 invariance of the electromagnetic and weak interactions. Orig. art. has: 7 formulas and 1 figure.

ASSOCIATION: Ob"yedinennyy institut yadernykh issledovaniy (Joint Institute of Nuclear Research)

SUBMITTED: 10Dec62 DATE ACQ: 12Jun63 ENCL: 00

SUB CODE: PH NR REF SOV: 002 OTHER: 003

Card 2/2